

§103 Rejection of the Claims

Claims 17-40 were rejected under 35 USC § 103(a) as being unpatentable over Wen. Wen teaches forming a trench storage capacitor directly in a substrate. Wen does not teach forming a memory cell based on the trench storage capacitor disclosed therein. Consequently, one is left using what is known in the art for forming a memory cell based on the Wen capacitor.

As the Examiner has pointed out, the Wen capacitor can indeed be used to form a memory cell. However, the capacitor structure of Wen *cannot* be made part of the transistor structure because the storage plate in Wen is polycrystalline, while a transistor structure is single crystalline. It is well understood in the art that polycrystalline silicon is not a suitable material for forming the source/drain region of a transistor because of the number of crystal defects and the leakage current that would result.

Thus, a memory cell formed using the Wen capacitor would necessarily require the use of conductors to form the electrical connection between the two different materials making up the source/drain region and the capacitor plate. In highly integrated memory cells such as a dynamic random access memory (DRAM), use of conductors to connect the capacitor to the transistor is very problematic because the conductors take up valuable space. This severely limits the level of integration of a memory cell.

Applicant's invention is directed to eliminating the need for using conductors to electrically connect the capacitor to the transistor in a memory cell. This is achieved by forming one of the plates of the capacitor as a single crystalline extension of a source/drain region of the transistor. Such a design leads to a "conductorless" electrical connection between the capacitor and transistor. The savings in space allows for a more highly integrated memory cell.

Applicant has amended the independent claims to distinguish their memory cell invention from that made possible by Wen by adding the structural limitation that the electrical connection between the transistor and the capacitor be a "conductorless" by virtue of one of the capacitor plates being integral with (i.e., a single-crystalline extension of) one of the transistor source/drain regions. The newly added independent claim also includes this structural limitation. Support for the amended claims and the new independent claim is found in the specification on page 6, line 26 through page 7, line 13, and in FIG. 1.

PRELIMINARY AMENDMENT

Serial Number: 09/467,992

Filing Date: December 20, 1999

Title: CIRCUITS WITH A TRENCH CAPACITOR HAVING MICRO-ROUGHENED SEMICONDUCTOR SURFACES

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Dkt: 303.389US2

Applicant believes the amendments to the pending independent claims and the limitations in the newly added independent claim renders these claims patentable over Wen and the cited references. It follows from this that the claims depending from the amended independent claims and the newly added independent claim are also patentable over Wen and the cited references.

Product-by-Process Limitations

Examiner has reminded Applicant that claims 20, 21, 23, 24, 27, 28, 33, 34 and 35 each recite a limitation that does not offer any structural variation to the final product.

Applicant has canceled claims 20, 21, 24 and 28. Further, Applicant has amended claims 23, 27 and 33-35 to remove the product-by-process language.

Conclusion

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney (612 373-6913) to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

LEONARD FORBES ET AL.

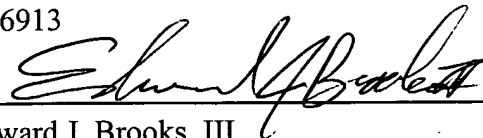
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